Numerical Methods for Atmospheric and Oceanic Sciences caters to the needs of students of atmospheric and oceanic sciences in senior undergraduate and graduate courses as well as students of applied mathematics, mechanical, and aerospace engineering. The book covers fundamental theoretical aspects of the various numerical methods that will help both students and teachers in gaining a better understanding of the effectiveness and rigour of these methods. Extensive applications of the finite difference methods used in the processes involving advection, barotropic, shallow water, baroclinic, and oscillation and decay are covered in detail. Special emphasis is given to advanced numerical methods such as Semi-Lagrangian, Spectral, Finite Element, and Finite Volume methods. Each chapter includes various exercises including Python codes that will enable students to develop the codes and compare the numerical solutions obtained through different numerical methods.

Key Features:

- Clear exposition of concepts such as stability, staggered grid, and nonlinear computational instability
- Background discussion to support the theoretical details of each numerical scheme
- Rich pool of pedagogy including programming examples using Python

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